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Uses of cactus for food, energy and job creation

Introduction

The world is reaching its limit on the amount of food that the seas and crops can generate. The available surfaces are deserts, which represent 42% of the Earth's surface. The pressure on natural resources is increasing. The pollution of rivers and oceans glimpses a bleak picture for humanity in the coming years. The nopal represents a hope for humanity of food and energy in a sustainable way.

Opuntia ficus-indica, has a wide distribution in the world and adapts to various climatic conditions, in some countries it is considered a pest, in others like Mexico a godsend.
To produce biomass in large quantities, a plant that adapts to various climatic conditions is required, resistant to pests, a true survivor where other species cannot tolerate. In addition to fast growth and simple molecular structure, which allows easy degradation. The nopal has all these characteristics. Therefore, it is the ideal species for an agro-industrial or bioenergy project.

The proposal to use nopal for energy was born at the University of Chile in the 80s, accidentally, and later Wayland in 2000 did his thesis and the first Biogas plant with cactus in the world was built for industrial use in the Elqui Valley chile associated with the carmine industry (a coloring insect that feeds on cactus. Later, it takes this technology to Mexico, South Africa and other countries.

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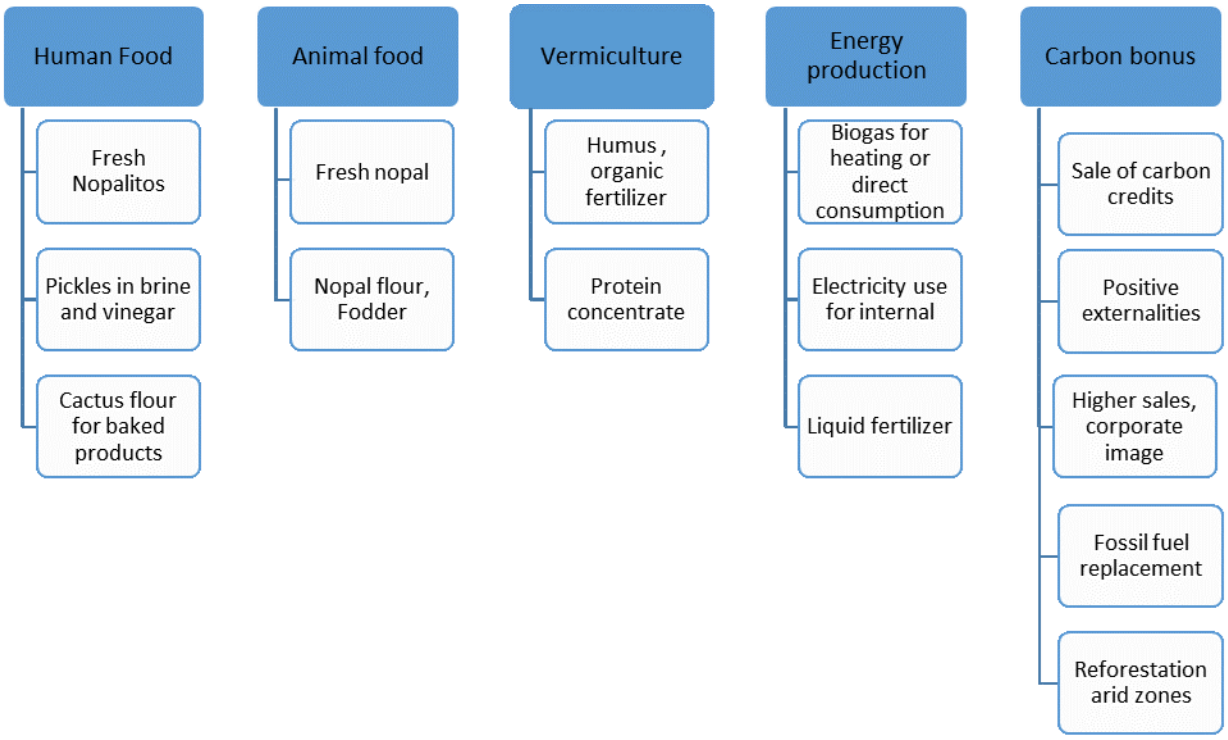
Work model

In the renewable energy industry, the most common is to sell equipment and advice, so if you want to install equipment you must buy it in Germany, Austria or the USA, transport it to its destination and install it, which increases costs. Our model is to sell engineering, adapt to the client, we use the equipment and facilities of the national market, we build with materials and local companies where projects are developed, this allows a greater social impact, job creation, social integration and less environmental impact at the point of destination. Our production process is 5 times cheaper both in equipment and in investment costs than other alternatives. We are the only company that offers this comprehensive service on food and energy with cacti. The pioneers in the world and with international experience.

Nopal applications (Cactus)



CACTUS ADVANTAGES

Continuous power generation 24 X 365 days. Biogas and electricity production. Without sulfur oxides or particles. Low maintenance. General efficiency of the plant 80-90%. Generate soil, organic fertilizers. Change the microclimate that retains water in the soil. Extract the atmosphere from carbon dioxide. Useful life 20 years. Allows the sale of carbon credits. Fully organic process. Rapid implementation of the project. Generate permanent jobs to plant crops and process plants. It allows the opening of new markets to be considered a green company that cares.

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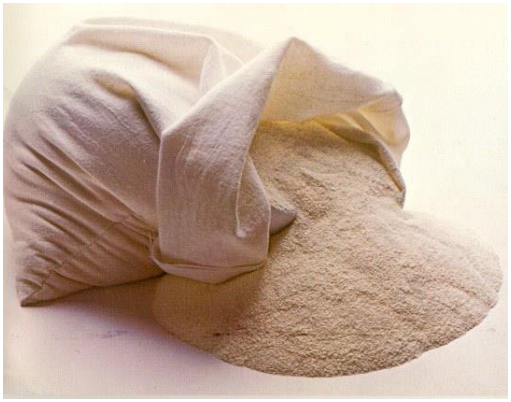
HUMAN FOOD

Its water content is high, about 90%, likewise, it contains minerals among which we find calcium, potassium, magnesium, sodium and small amounts of iron, aluminum, among others. It contains fibers, vitamins A, C, K, B1, B2, B3 and B6 and chlorophyll. It can be prepared roasted, in salads, as well as in brine, vinegar and other preparations. The nopal can be dehydrated and produce flour for making tortillas and baked goods.

ANIMAL FEEDING

Foliage can be used as a staple food for goats, sheep and rabbits, and as a dietary supplement, instead of concentrates, for dairy cattle, and as a feed ingredient for monogastric animals, such as pigs. You can use direct feeding in situ, with cattle or goats which are fed directly from the plant or can be cut into pieces and make rations in pens. Likewise, nopal flour can be obtained for storage and subsequent administration in winter rations or its sale in the wholesale market.

VERMICULTURE



Applied to prickly pear, it allows obtaining two products, humus and worm meal, both of excellent quality and considerable volume. Normally there is a resistance to using earthworms as food or the elaboration of flours because they are used in agricultural waste, however, the nopal allows by means of a vegetable cultivation the obtaining of products without the negative microbial load associated with waste treatment, They are earthworms fed with vegetables for which a homogeneous product is obtained. The applications of the flour are in feed for chickens, farmed fish, goats, pigs and industrial animals as a complement to rations.

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ENERGY PRODUCTION

Cultivation of biomass for the production of biogas is exclusive to prickly pear, biogas plants in the world normally use agricultural or industrial waste, sewage or similar. The design of processes to produce energy through cultivation and transformation is usually not viable without subsidies, this occurs with ethanol in the USA or biogas in Europe. This problem does not occur with prickly pear, which is profitable and competitive with other renewable sources such as panels and wind farms. The great advantage is that it supplies energy 24 hours and its production can be regulated, thus adapting to demand. The conversion of biogas into electricity uses equipment similar to that required by natural gas.

CARBON CREDITS

In the most important benefits we can indicate the generation of permanent jobs in remote areas of Africa or marginal areas and green or carbon bonds, will allow, by themselves, the financing of large-scale plantations, Our systems are organic crops, plants of process with recyclable materials, we are committed to sustainable development. Prickly pear crops for energy multiply life in deserts. The greatest impact is found in the replacement of fossil fuels.

JOB CREATION AND FLEXIBILITY

The projects with nopales have wide flexibility and can be oriented to the creation of permanent jobs, in planting, harvesting and processing, as well as highly mechanical systems to produce large income with a minimum of personnel, it is perfectly possible to implement a mix with the alternatives indicated.

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TABLE A: NOPAL ALTERNATIVE SUMMARY

	Energy (Biogas electricity)	Nopalitos in brine or vinegar
Equipment and machinery	Mostly available in the local market. Some equipment must be imported	Available in the local market mostly. Autoclaves must be imported.
Investment	Half	Middle-low
Technology	Medium, known technology	Low, simple systems to operate
Employment generation	Half	High, labor required for manual harvesting and processing
Qualification of workmanship	Low, basically in crops and medium in process plant.	Medium, staff can be trained
Implementation	24 months for full production	12 - 18 months for first cut
Profitability US / hectare	20.000	25.000
Development capacity	Very High	Very high
Production	All year	All year
Barriers	Non-existent legislation for this type of products	Undeveloped marketing

TABLE B: NOPAL ALTERNATIVE SUMMARY

	Nopal for animal feed	Nopal powder / Flour
Equipment and machinery	Available in local market	Available in the local market
Investment	Baja, establishment of pens and drinking fountains (water intake)	Media, drying equipment
Technology	Low	Known and widely used
Employment generation	Medium low, one operator can handle many animals.	High, labor required for manual harvesting and processing
Qualification of workmanship	Get off, train yourself	Medium, staff can be trained
Implementation	12 months first cut	18 months
Profitability US / hectare	-------	50.000
Development capacity	High, limited to land availability and management	Very high for animal feed
Production	All year	All year
Barriers	Requires intensive breeding	Undeveloped marketing

TABLE C: NOPAL ALTERNATIVE SUMMARY

	Vermiculture Production Humus	Vermiculture Protein concentrates
Equipment and machinery	Available in local market	Available in the local market
Investment	Low, establishment of vermiculture beds	Media, drying equipment
Technology	Low	Known and widely used
Employment generation	Medium low, one operator can handle many beds.	High, labor required for manual harvesting and processing
Qualification of workmanship	Get off, train yourself	Medium, staff can be trained
Implementation	24 months for full production	18 months
Profitability US / hectare	$ 35,000 / hectare	$ 35,000 / hectare
Development capacity	High, limited to land availability and management	Very high for animal feed
Production	All year	All year
Barriers	Requires intensive rearing of worms	Undeveloped commercialization, use in industrial animal feed, goats, cows, pigs.

TABLE 2 NOPAL PERFORMANCE WITH OTHER ENERGY SOURCES

CROP	Performance	Fuel	Energy	Energy	Performance Energy Relative
	(L/hect-year)		**Kcal**	**(Mcal/hect-year)**	**Base: Nopal**
Nopal (Opuntia)	**25.000**	**Biogás (*)**	**7.000 kcal / M3**	**364.000**	**100%**
Palm	5.550	Biodiesel	9,260 Kcal / L	51.393	29,4%
Coconut tree	4.200	Biodiesel	9.260 Kcal / L	38.892	22,2%
Higuerilla	2.600	Biodiesel	9.260 Kcal / L	24.076	13,8%
Avocado	2.460	Biodiesel	9.260 Kcal / L	22.780	13,0%
Jatropha	1.559	Biodiesel	9.260 Kcal / L	14.436	8,2%
Rape	1.100	Biodiesel	9.260 Kcal / L	10.186	5,8%
Soy	840	Biodiesel	9.260 Kcal / L	7.778	4,4%
Sugar cane	9.000	Bioetanol	5.000 Kcal /L	45.000	25,7%
Beet	5.000	Bioetanol	5.000 Kcal /L	25.000	14,3%
Yucca	4.500	Bioetanol	5.000 Kcal /L	22.500	12,9%
Sweet sorghum	4.400	Bioetanol	5.000 Kcal /L	22.000	12,6%
Corn	3.200	Bioetanol	5.000 Kcal /L	16.000	9,1%

(*) (M^3biogas / hect / year) Average plantation density (75% Methane)

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